

MISSISSIPPI MAKEOVER

A Plan for Restoration, Just Around the Bend

National Park Service
Mississippi River Forum
May 15, 2009



Project Description

- Local effort to *envision* and plan for ecological restoration in Spring Lake, Lower Vermillion River, and Pool 3
- Part of larger Lake Pepin TMDL implementation plan

A Plan for Restoration,
Just Around the Bend



Project Partners



Dakota County



Dakota County Soil and Water
Conservation District



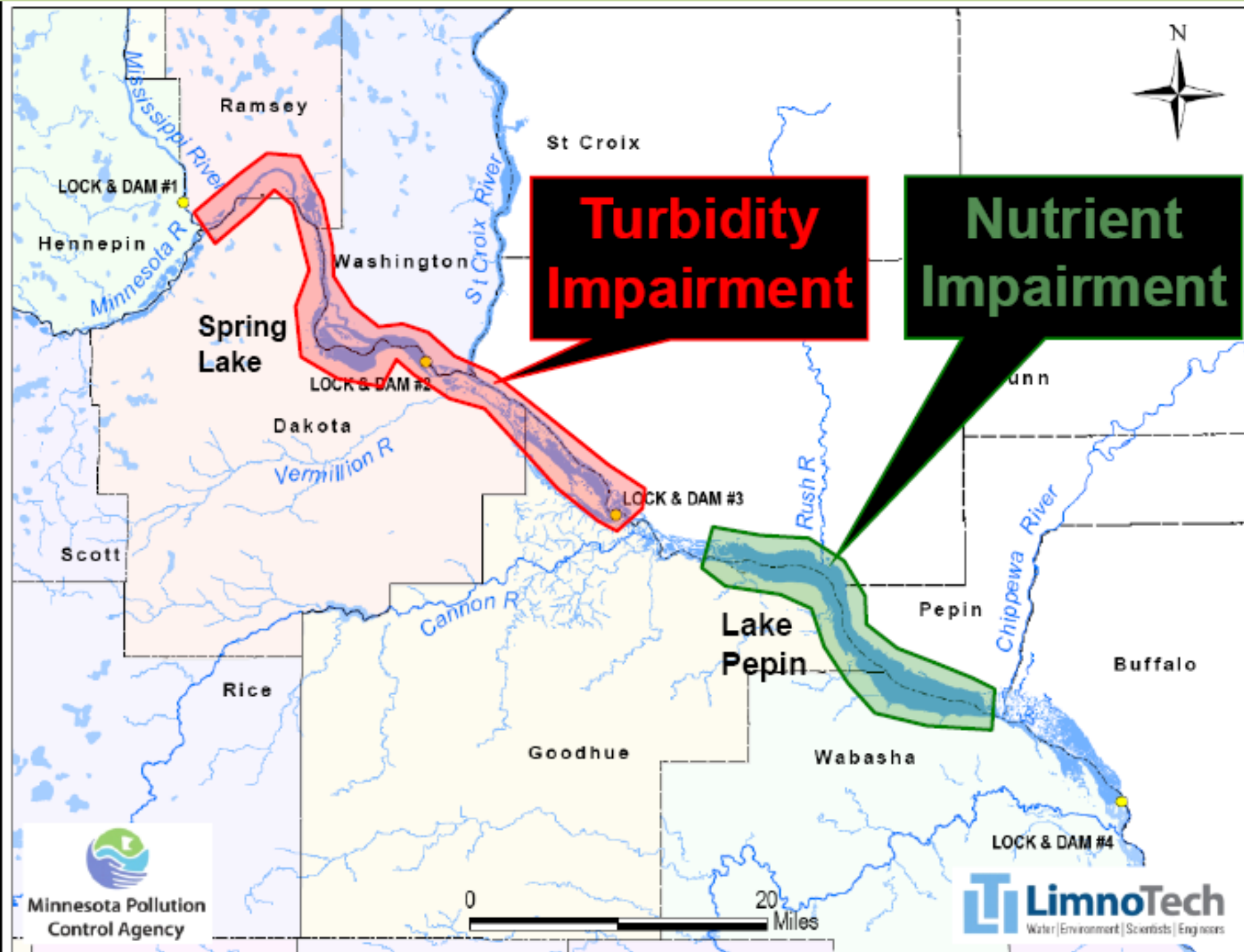
MN Pollution Control Agency



MN Department of Natural
Resources

Mississippi Makeover Project Area





Project Description

Mississippi River/Lake Pepin TMDL

Sub-watershed Project

Mississippi Makeover

Sub-watershed Project

Stakeholders

Indicators
& Targets

Technical Experts

Spring Lake Projects

Lower VR Projects

Pool 3 Projects

Build Islands ?

Remove Rough Fish ?

Drawdown ?

ACOE

DNR

PCA

FWS

NPS

NGOs

Counties

Cities

Twps

Project Goals

- A healthy and restored ecosystem
 - Improved water quality
 - Abundant wildlife
 - Recreational opportunities
 - Economic vitality
- Congruent and complimentary projects among agencies
- A comprehensive plan for implementation of TMDL in these areas



Spring Lake

- Shallow floodplain lake within Pool 2
- Adjacent to main shipping channel
- Approximately 1,500 acres with mean depth of 4.3 feet
- Pre-settlement floodplain forest and marsh
- Dominated by planktonic algae; very little submerged or emergent vegetation



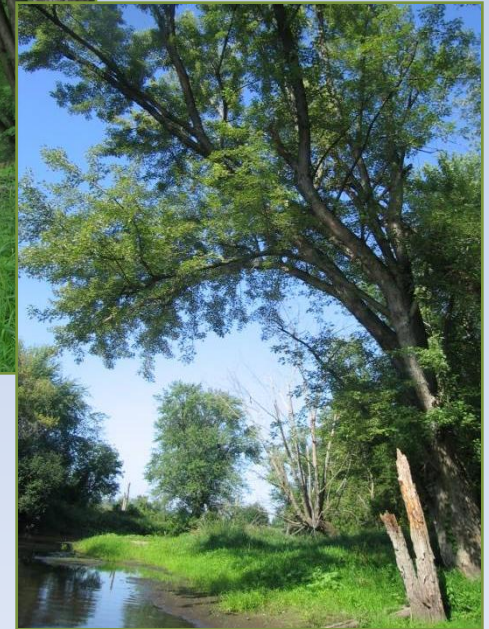
Lower Vermillion River

- Downstream section of Vermillion River



Lower Vermillion River

- Large forested floodplain
- Many large lakes between Vermillion and Mississippi



Lower Vermillion River

- Dominated by Mississippi R. during high water through dikes and sloughs

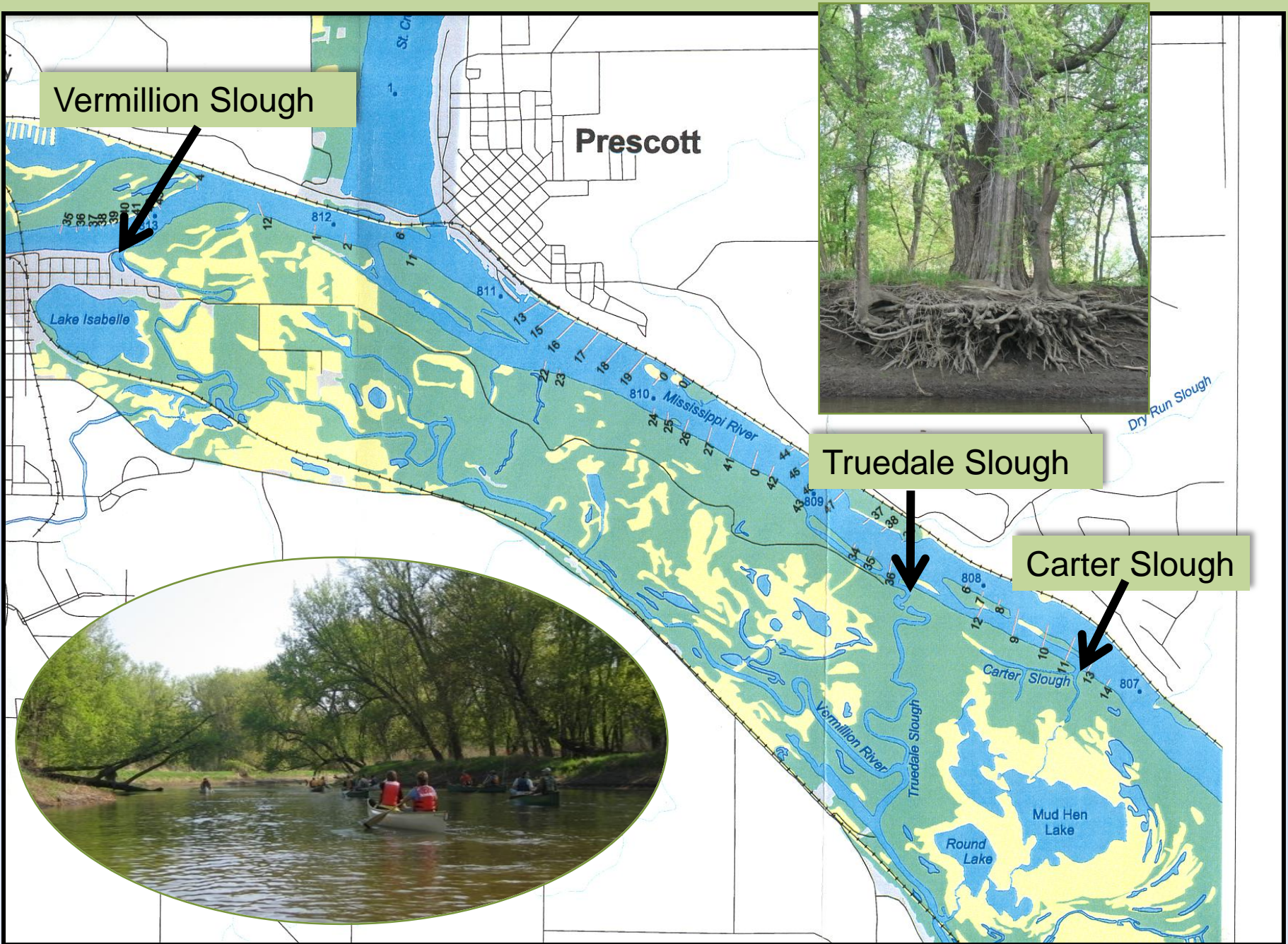
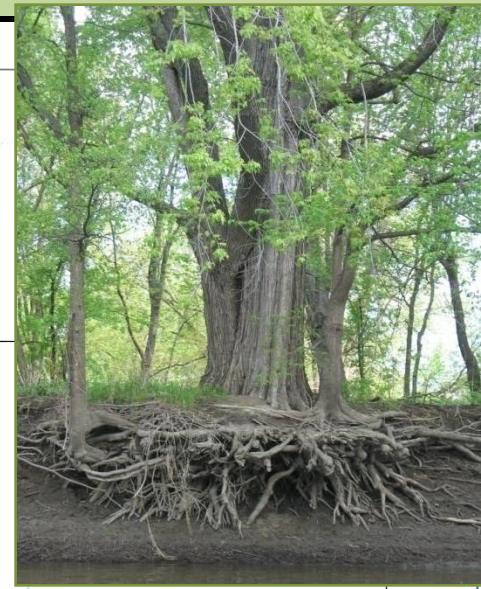


Vermillion Slough

Prescott

Truedale Slough

Carter Slough



Mississippi River Pool 3

- Confluence with St. Croix
- Xcel Energy Nuclear Plant
- Prairie Island Indian Community
- Marinas



Project Tasks

1. Identify and convene local stakeholders to envision and develop indicators of successful restoration

Citizen Advisory Group meetings:

- December 2008
- April 2009

Citizen Advisory Group members:

- Local citizens
- State and local officials
- Industry
- Organizations



Selecting indicators based on river science

High turbidity, poor vegetation



Use water level management to expose sediment



Sediments dry & oxidize, dormant seeds germinate, plants emerge



Vegetation collects sediments and improves water clarity



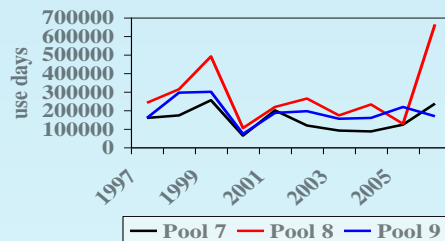
Clear water helps vegetation persist



Swans eat vegetation



Swans numbers increase



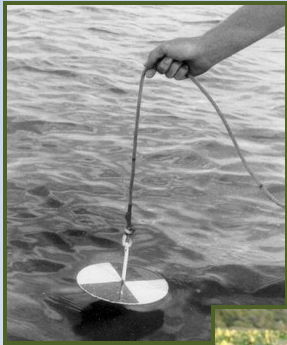
Bird watchers vacation near swans



Tourism \$\$ increase

Chosen Indicators

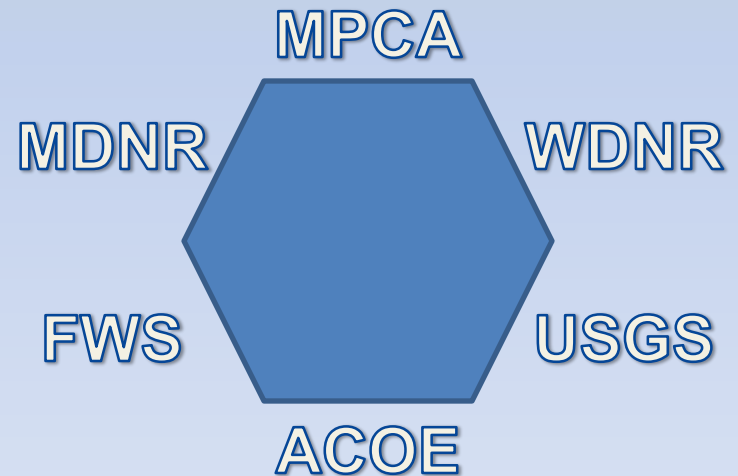
- ✓ Sedimentation
- ✓ Water clarity
- ✓ Vegetation
- ✓ Invertebrates
- ✓ Fish
- ✓ Waterfowl



Project Tasks

2. Convene technical agencies to develop ways to measure chosen indicators

- ✓ Report known data
- ✓ List all metrics
- ✓ Determine best metrics
- ✓ Recommend targets



Mississippi Makeover

Background Info

Provided CAG with fact sheets and background info on certain areas and metrics



Aquatic vegetation is one of the most important components of a healthy aquatic ecosystem. Aquatic vegetation includes floating-leaved plants that are rooted to the bottom with leaves that float on the water (e.g. American lotus), submerged plants that grow entirely underwater (e.g. wild celery), and emergent plants that grow above water in shallow areas along shorelines and in marshes (e.g. arrowweed). Aquatic vegetation is influenced by bottom type, flow, and water clarity and can be measured in a variety of ways. These techniques include **percent frequency of occurrence**, **species richness**, and **biomass**.

Percent frequency of occurrence is a measure of how frequently aquatic vegetation occurs in a given area. 100 sites are sampled randomly, and aquatic vegetation is present at 10 sites, percent frequency of occurrence is 10%. Frequency of occurrence gives a general idea of the distribution of plants within an area, or percent frequency of occurrence in the reach upstream of Lake Pepin is low, averaging only 1% along a channel and lake channel areas where it is consistently measured. In the reach of river downstream of Lake Pepin, where there is better water clarity, the average is over 40%.

Species richness is a measure of the number and kinds of species present. Generally, the more species present, the healthier the system. Currently, there are a maximum of 8 species found along lake shore the main channel in the reach upstream of Lake Pepin, compared to a maximum of 13 species found downstream. Water clarity improvements upstream of Lake Pepin should result in an increase in the number of species.

Biomass is a measure of the productivity and abundance of aquatic plants. While frequency of occurrence species richness tell us how often and what types of plants are encountered, they don't tell us how big these plants communities are. Biomass is calculated by measuring the dry weight of plants in a given area, such as a square meter. Biomass is not often measured, as it is labor intensive and information to collect and analyze.



Invertebrates are the bugs and snails (mollusks) found in the river. There are many types of invertebrates and their presence and numbers depend upon substrate, vegetation, flow, nutrients, dissolved oxygen factors. Invertebrates are good indicators of ecosystem health. Some populations (like mayfly nymphs) quickly respond to changes in water quality and physical conditions, while others (like mollusks) are affected by long-term changes. Much attention has been placed on mussel populations in recent years, and good data available to monitor the status of their populations. Much less information is available regarding all invertebrates in the reach of river upstream of Lake Pepin. Common measurements to track invertebrates include **catch per unit effort** and **species richness**.

Catch per unit effort for mussels is often measured as the number of mussels collected per minute in a standardized size survey. It can be reported as the percent of sites with various abundances of mussels (e.g. 1 mussel/minute, 2 mussels/minute, etc.). This gives a relative abundance of mussels in a given area. In the reach upstream of Lake Pepin, there were 33 out of 100 sites with 1 mussel per minute, and 10 sites with 10 mussels per minute.

Catch per unit effort for other invertebrates can be measured as number per square meter. This sampling method was used in 1992-2002, but was discontinued due to funding constraints. Mayflies are one of the most commonly recognized species, giving volunteers from the sometimes incredible hatches on mid-summer nights that have forced volunteers to clear bridges crossing fish with dead mayflies. From 1992-2002 there were an average of 122 mayflies/ha/meter of square meter in Lake Pepin.

Species richness is the number of different species collected. Historically, 41 species of mussels were found in the Upper Mississippi River, the most diverse array of species in North America. Currently, 28 species are found in the reach upstream of Lake Pepin. Some species, like the Mucket mussel, were historically abundant but have not been collected above Lake Pepin for many years. Data on species richness for other invertebrates is limited.



Sedimentation is the deposition of soil (sand, silt and clay) and organic matter (decomposing plant material and their Rhizoids). Sediment comes from tributary water sheds, and from within the river (Lake Koshong). Lake Pepin is a natural sink for sediment. The 50% current almost all of the sediment on Lake Pepin to settle on the bottom. Common measurements for sedimentation are **bed rate**, **sediment load**, and **sedimentation rate**.

Sediment load is a measure of how much sediment is transported past a specific location over a set time (the case of Lake Pepin, almost all of the sediment moving past Red Wing is deposited in Lake Pepin). The load to Lake Pepin currently averages about 1,000,000 metric tons per year compared to the natural load rate of 80,000 metric tons per year. The current load is equivalent to about one city block covered by 10 cm of sediment. The Lake Pepin NREI study currently estimates that 75% of the sediment load to Lake Pepin from the Minnesota River.

Sedimentation rate is a measure of how fast sediment is accumulating. Under the natural background sedimentation rate would take 4,000 years to fill Lake Pepin while the current sedimentation rate will fill Lake Pepin in 12 years, or in just 100 years.

Sediment composition is a measure of the proportion of different sediment particles in a sample. Larger sediment particles, like silt and clay, move under very high flows and are usually found along the main channel and larger lake channels. Sand is usually the dominant substrate in most of the continuously flowing channels. Silt and clay are lighter and settle out in calm areas such as backwaters. About 70% of the sediment deposited in Lake Pepin is silt and clay. Muck, the sludge and phosphorus are often attached to silt and clay particles. Different mixtures of sand, silt, and clay are desirable to provide a diversity of substrates for the establishment of aquatic plant beds and for variety in habitat conditions within the floodplain.



There are many different kinds of fish in the Upper Mississippi River, including game fish, panfish, non-game, and forage fish. Game fish are the most well known and include popular species sought by anglers like walleye, largemouth bass, and channel catfish. Panfish are generally more common than game fish and include bluegill, crappie, white bass and other smaller species that are also popular with anglers. There are many species of non-game fish, some of the most well known include rock bass, freshwater drum, bowfin, sandfish and darters. Forage fish include many species of minnow and sunfish that serve as a food source for larger predators. Striped bass and alewife are two of the most common. There are also many rare native species found in specific habitats, like the crystal darter which lives in deep channels with high current, the sand darter found in backwaters with abundant vegetation, and the spottail shiner which is a long distance migrant found here only during a following flood events. In addition, invasive species are present, the common carp and the recently discovered ligand and other carp are causing great concern.

Fish are sampled by several agencies throughout all Mississippi River pools. Common measurements to track fish include **catch per unit effort**, **size structure**, and **species assemblage**.

Catch per unit effort is measured as the number of fish per sampling unit. Sampling unit could be number caught per hour of electrofishing, number per acre netted, number per trap net 100 yds. Since different species of fish are found in different habitats, and are vulnerable to different sampling gear, a variety of sampling methods are often used. It is difficult to use fish populations without extensive sampling. Comparing catch per unit effort over time provides an indication of changes in fish abundance.

Size structure is the range of sizes within an individual species at a given time. It is important to know how many fish of a given species are present, how many are adults, and the relative percent of each size in the population. Size structure can help identify problems with reproduction, growth, or other factors that might affect fish. Size structure data are usually collected on gamefish and panfish, and less frequently on non-game and forage fish.

Species assemblage is a good measurement of the overall fish community. It is represented by the percent of the overall fish population comprised by individual species. Different habitats will have a different assemblage of fish. For example, clear backwater areas with abundant vegetation will have a different assemblage than muddy backwaters with little vegetation. The species may be similar, but the proportion of each species could vary greatly.



Water clarity is simply, how far you can see into the water. It is influenced by the amount of suspended and material in the water. Suspended material in the water is often referred to as **total suspended solids (TSS)**, which both organic solids, such as algae, and inorganic solids such as sediment. Dissolved organic material will produce a colored color that will reduce water clarity. Common measurements of water clarity include **Secchi disk transparency**.

Secchi disk transparency is a measure of the light scattering properties of water and is measured using a turbidity meter, with results reported as Nephelometric Turbidity Units (NTU) or a similar unit. As turbidity increases and NTU values are high, light disappears more rapidly with depth due to scattering and absorption. Lake Pepin is measured for clarity in the reach just above Lake Pepin, turbidity during the summer averaged 3.2 NTU over the past 10 years. The state standard is 25 NTU.

Secchi disk transparency is a simple, inexpensive, and straight forward method of measuring water clarity. A black and white disk, 30-cm in diameter, is lowered into the water on the side of the boat until it disappears and then raised until it reappears. The average of two depths is recorded as the Secchi disk transparency. This is not an exact measure, as the sun's glare or the sun's position can affect the readings, however, it is a simple and reliable measure. It is a widely used and commonly accepted method of water clarity. In the reach just above Lake Pepin, Secchi disk transparency averaged 4.3 m from 1993-2007, while during the same period Secchi disk transparency was 6.3 m at the lower end of Lake Pepin. Secchi disk readings from throughout Lake Pepin 1993-2007 are:

	Upper	Midway	Downstream	Maximum
Lakeville	68.2	63.0	17	358
Frontier SP	65.0	64.0	17	121
Stoughton	58.4	57.0	18	170
Lake City	73.2	72.0	25	196
Maple Springs	66.0	66.0	38	358



Project Tasks

3. Develop quantifiable targets for each indicator

Indicator	Natural Background	Existing	Interim Target	Long Range Target
Water Clarity TSS Secchi Depth	<10 mg/L	47 mg/L 38.5 cm	TBD	TBD
Aq. Vegetation Species Richness		9 species	TBD	TBD
Sedimentation of Lake Pepin	80,000 metric tons/yr	865,600 metric tons/yr	TBD	TBD
Invertebrates Species Richness	41 species	28 species	TBD	TBD

Project Tasks

4. Develop viable restoration activities including land and river management



- ✓ Water Level Mgmt
- ✓ Island Building
- ✓ Rough Fish Removal
- ✓ Land Protection
- ✓ Land Restoration

Project Tasks

5. Develop TMDL Implementation Plans

- ✓ Environmental Pool Plans
- ✓ Spring Lake Park Preserve Master Plan
- ✓ Watershed Management Plans
- ✓ Wildlife Management Area Plans
- ✓ Mississippi National River & Recreation Area Strategic Plan



Future Roles for Stakeholder Group?



- Advisors
- Advocates
- Watch Dogs
- Reporters

Mississippi Makeover Project Website/More Info

- www.dakotawcd.org/wshd_missmak.html
- laura.jester@co.dakota.mn.us

